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ABSTRACT

This final report contains the program proposal with supporting data for developing curriculum materials for and implementing an associate-degree laser technology program at the North Central Technical Institute. The proposal outline provides this information: (1) objectives for the program designed to prepare a technician to safely operate, maintain, repair, and evaluate laser systems used in various applications; (2) program rationale (need and population support); and (3) curricular materials. These include a proposed two-year (four-semester) curriculum, course descriptions, and information on instructional personnel, faculty, and equipment needs. A section on program implementation outlines the process for new program development. (YLB)

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CE 025 562

LASER TECHNICIAN

ASSOCIATE DEGREE PROGRAM

A PROPOSAL SUBMITTED TO
WISCONSIN STATE BOARD OF
VOCATIONAL, TECHNICAL AND ADULT EDUCATION

(CURRICULUM DEVELOPMENT)

North Central Technical Institute

Wausau, Wisconsin

FINAL REPORT

Project No. 15.299.150.318

Lawrence B. Hoyt, District Director

North Central Vocational, Technical and
Adult Education District

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

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L. Harmatuck

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INTRODUCTION

During the 1976-77 school year, a physical science (physics) instructor at NCTI was on sabbatical leave to the Technical Education Resource Center at Waco, Texas studying the potential to develop a laser technology program at NCTI as well as to update his technical skills on laser technology.

As a result of his completing the sabbatical, during the 1977-78 school year, this instructor worked half-time on the development of curriculum materials and program proposals for implementing the laser technology program at NCTI. This program was designed to start in the fall of 1978.

One of the requirements for the submission or the start of an associate degree laser technician program at NCTI was the submission to the Wisconsin Board of Vocational, Technical and Adult Education the complete program proposal. This proposal occupied much of Mr. Johnson's time during the 1977-78 school year. The proposal submitted to the WBVTAE follows.

In addition to this proposal, the detailed outlines for the first year courses were tentatively developed, and would be revised as the first year instructional activities were started. Mr. Johnson also spent some time in the first year development phase of helping write and submit two project proposals to the National Science Foundation, one was under the Comprehensive Assistance Undergraduate Science Programs or CAUSE, and the other

was the Instructional Scientific Equipment Program for Undergraduate Education.

The brochure describing the Laser Technology program was developed during the 1977-78 school year by Mr. Johnson which will be used in promoting the Laser Technology Program.

State of Wisconsin \ BOARD OF VOCATIONAL, TECHNICAL & ADULT EDUCATION

EUGENE LEHRMANN
State Director
4802 Sheboygan Avenue 7th Floor
MADISON, WISCONSIN 53702

February 7, 1977

Mr. Lawrence B. Hoyt, District Director
North Central Vocational, Technical and
Adult Education District
1000 Schofield Avenue
Wausau, Wisconsin 54401

Dear Mr. Hoyt:

The State Director, on the recommendation of the Division of Community and Manpower Education, has taken the following action on Indication of Interest Form, VE-CU-2:

Code No.	Program	WBVTAE Consultant	Type	Action
T10-622-2	Laser Technician	Harlan Klintworth	Associate Degree	Proposal Requested (6 copies)

Previous to presenting this request for program designation to the Wisconsin Board of Vocational, Technical and Adult Education for approval, it will be necessary to provide this office with a proposal as outlined in the VTAE Career Program Procedures Manual. This request should not be construed as authorization to proceed with program development.

Upon receipt of your proposal and satisfactory review by this office, it will be presented to the Wisconsin Board of Vocational, Technical and Adult Education for program designation.

Notification of the action taken will be sent you.

Sincerely,

Jack W. Smythe

Jack W. Smythe, Director
Bureau of Program Accountability
Division of Community and
Manpower Education

jd

State of Wisconsin \ BOARD OF VOCATIONAL, TECHNICAL & ADULT EDUCATION

EUGENE LEHRMANN
State Director
4802 Sheboygan Avenue 7th Floor
MADISON, WISCONSIN 53702

November 22, 1976

Mr. Lawrence B. Hoyt, District Director
North Central Vocational, Technical and
Adult Education District
1000 Schofield Avenue
Wausau, Wisconsin 54401

Dear Mr. Hoyt:

This is to acknowledge receipt of your recent Indication of Interest Form requesting consideration of the following program:

Code No.	Program	WBVTAE Consultant	Type
*T10-622-2	Laser Technician	Harlan Klintworth	Associate Degree

After review by the State Director and the Division of Community and Manpower Education, you will receive notification of the action taken on your program request.

Sincerely,

Jack W. Smythe

Jack W. Smythe, Director
Bureau of Program Accountability
Division of Community and
Manpower Education

jd

*T = Temporary Code Number

Lawrence B. Hoyt, District Director
North Central Technical Institute
1000 Schofield Ave., Wausau, Wisconsin 54401
Telephone 715-675-3331

November 12, 1976

Mr. Eugene Lehrmann, Director
Wisconsin VTAE Board
4802 Sheboygan Avenue, 7th Floor
Madison, Wisconsin 53702

Dear Mr. Lehrmann:

NORTH CENTRAL VOCATIONAL TECHNICAL AND ADULT EDUCATION DISTRICT

Enclosed is our Indication of Interest form requesting permission to study the need for an Associate Degree program in Laser Technology. Local firms indicate an expanded interest in securing personnel with this type of skill. In addition, NCTI has already invested considerable dollars in providing a sabbatical leave last year for Mr. Johnson to become knowledgeable in this area.

Your favorable consideration of this request will be appreciated.

Sincerely,

Lawrence B. Hoyt, Director
North Central VTAE District

LBH:RP:ih

enclosure

VB-CU-2
5/72

District North Central Tech.
School NCTI - Wausau
Date Submitted 11/12/76

This form is an indication of interest in the development of a new program and does not replace the program proposal. The information need not be in detail, but should be a brief, realistic appraisal of the program.

1. Standard Program Title: Laser Technician

2. Type of Program Anticipated:
   XX Associate Degree — Diploma - One Year
   Diploma - Less Than One Year — Diploma - Two Year

3. Program Description/Occupational Group To Be Served:
This associate degree program is designed to teach fundamentals of laser operations to enable graduates to obtain employment as a technician in fields such as: medicine, industry and research. This program will provide laser technicians for work in a variety of technical areas in addition to those mentioned.

4. Projected Student Enrollment: 15-20 each year

5. Source of Interest:
1. National need for Laser Technicians.
2. Expanded uses in a variety of occupations.
3. North Central Health Foundations in Wausau presently has one of the most powerful systems in the country and have offered their cooperation and assistance.

6. Allied Programs/Courses Presently Offered:

X	Full Time	Part Time	Title	Electronics Technology	Number	10-605-1
X	Full Time	Part Time	Title	Radiologic Technology	Number	10-526-1
X	Full Time	Part Time	Title	Nursing - Technical	Number	10-510-1
	Full Time	Part Time	Title	Machine Tool	Number	32-420-1
	Full Time	Part Time	Title	Welding	Number	31-442-1
				Mechanical Design		10-606-1

7. Staff Needs:
Will Current Administrative, Ancillary, and Teaching Staff Be Adequate To Implement The Program - - - - - - - - - Yes No

If No, Indicate Number Of New Staff Required 1 teacher to replace present Science instructor who would instruct in this program.

Anticipated Salary Costs Of New Staff $12,000

District Director — Nov. 12, 1976 (Date)

Principal Investigator — Nov. 12, 1976 (Date)

PHILOSOPHY OF SCHOOL

Philosophy and Objectives

The North Central Vocational, Technical and Adult Education District recognizes its responsibility as a full partner in Wisconsin higher education along with the University of Wisconsin. Together with the University of Wisconsin-Marathon County Center located in Wausau and the University of Wisconsin-Stevens Point, the North Central Technical Institute must provide post-secondary educational opportunity for all of the people in north central Wisconsin.

The Board, through the North Central Technical Institute's comprehensive campus in Wausau, branch campus in Antigo, and other rented facilities in over 70 different locations throughout the North Central VTAE District, seeks to bring educational opportunity to individuals throughout their lifetime.

These opportunities make it possible for people to expand their knowledge and capabilities as useful citizens, enabling them to obtain, retain, advance, and change employment in accordance with their desires, needs, abilities and circumstances dictated by an increasingly complex, ever-changing employment market.

The North Central Technical Institute's objectives to meet the educational needs of the people of this multi-county area might be summarized as:

1. To prepare persons for employment in a wide variety of mid-management, technical, skilled and semi-skilled positions.

2. To upgrade the capabilities of persons employed, to enable them to maintain employment by keeping abreast of technological advances and/or to advance in their field of employment.

3. To develop new capabilities in employed persons to meet their desire or the necessity for job change.

4. To assist persons in self-evaluation and determination of career direction through testing, counseling and guidance so that they may, through education, realize their maximum employment potential.

5. To provide an opportunity to remove deficiencies according to individual needs of people who lack adequate proficiency in background courses necessary for success in the vocational or technical curriculum they seek to pursue.

6. To encourage and provide opportunity for persons presently involved in education related to employment, to also develop as an individual, to meet responsibilities as a member of a family and citizen of a free society.

7. To provide area leadership, educational programs, educational services, and facilities, consistent with the institution's objectives, desired by the persons in north central Wisconsin residing in the North Central Vocational, Technical and Adult Education District.

PROGRAM PROPOSAL OUTLINE

I. Type of program being developed

This proposed program will be a two year Associate Degree program offered in the Technical Department on the Wausau Campus. This program will not only be offered during the day to full time students but courses will also be available in the evening hours for part-time students who desire to upgrade their skills in laser applications, or perhaps obtain an associate degree. This proposed program is designed to prepare a technician to safely operate, maintain, repair and evaluate laser systems used in various applications.

II. Program objectives

1. To provide a formal educational program in Laser Technology leading to an associate degree.

2. To provide students with the knowledge, skills, and experiences necessary to obtain employment as a laser systems technician.

3. To provide a prepared work force needed to meet the rapidly increasing demand for trained technicians in the field of laser technology.

4. To provide a program for presently employed technicians to upgrade their skills for advancement on the job, by offering a continuing education program.

III. Program rationale

The laser was first demonstrated in the early 1960's. Potential uses for this unique source of light appeared to be numerous. Research on laser applications expanded rapidly with the greatest emphasis on military devices. Laser weapons and laser range finding devices soon became commonplace throughout the military. The unique characteristics of the laser became widely known and as a result several private companies developed laser systems for use in private industrial and medical applications. Present day laser applications can be grouped into the following classifications:

1. Construction and excavation
2. Machining and materials processing
3. Communication systems
4. Distance and angle measurement
5. Non-destructive testing and measurement
6. Data processing and storage
7. Medical
8. Military and space projects
9. Energy research and development

Laser systems incorporate the concepts and principles of several technologies into a sophisticated and very useful industrial device. Laser systems contain optical, electrical, thermal, and mechanical devices. The Laser Systems Technician must have knowledge of electronic circuits, computer and numerical control systems, cooling systems, lasers, and electro-optic devices to utilize the laser to its greatest potential.

A. Need

The United States Office of Education (U.S.O.E.) provided funds for the Technical Education Research Center - Southwest (TERC-SW) to develop a two year model curriculum leading to an associated degree in Laser/Electro Optics Technology (LEOT). The development phase of this project was completed in December 1974. In 1975 and 1976, the U.S.O.E. again financed TERC-SW to disseminate the LEOT curriculum throughout the nation. Several industrial surveys were conducted in different states to determine the need for a trained work force in laser technology. The results of such surveys are summarized in the following table.

State or Region	Jobs for Laser Technicians				
	1977	1978	1979	1980	1981
New Jersey	109	80	90	96	172
Florida	51	63	No projections		
Southern California	119	193	No projections		

In addition to present job variances, most employers responding to the surveys indicated a projected 10 year increasing employment need of from 25% to 100%.

Realistic projections made from these surveys are explained in the article "Wanted: Laser/Electro-Optics Technicians" written by D. C. Winburn of Los Alamos Scientific Laboratory and Daniel M. Hull of Technical Educational Research Center. The article appeared in the November 1976 edition of Electro-Optics Systems Design. A copy of the article is included in Appendix A.

It should be noted that the largest percentage of employers responding to the above mentioned surveys were manufacturers of laser equipment. The surveys do not include businesses and industries which have purchased laser equipment and require a competent technician to operate

and maintain the device. A complete analysis of the users of laser equipment is virtually impossible because of the vastness and complexity of laser applications.

Laser usage has become widespread in such applications as construction alignment, metal processing, wood, fabric and plastics processing, medical diagnosis and treatment, data storage, nondestructive testing, precision measurement and energy research.

B. Population support

On a regional basis, it is well known that several industries and medical facilities use lasers and electro-optic devices.

Examples of a few of these employers include the following: (This is not intended to be a comprehensive list.)

Michigan:	General Motors (most divisions) KMS Fusion, Inc. Ford Motor Co. Jodon Engineering Associates
Illinois:	Union Carbide Bell Laboratories
Minnesota:	Honeywell, Inc. 3-M Company Medtronics Thermo-Systems, Inc. Hutchenson Industries

A rapidly advancing interest and use of lasers in Wisconsin can be seen at firms such as the following:

1. W. H. Brady Co.
2. Allis Chalmers
3. M. G. Cutting Systems
4. Sylvan Brothers Construction Co.
5. Beaver Dam Hospital
6. Kelbe Brothers Equipment Co.

Several indicators suggest that the laser industry is rapidly accelerating in the Wausau area too. The A. Ward Ford Memorial Institute in Wausau has been researching laser applications in the medical field for several years. Mark Laser Systems is a newly developed consulting firm for laser systems established in Wausau. Connor Forest Industries of Wausau is seriously considering the purchase of a laser device for wood processing applications. Several other local firms have expressed

interest in laser technology by sending representatives to non-credit classes and seminars on laser applications conducted at NCTI during the past year. Some of these firms include Drott Mfg. Co., Zimpro, and American Can.

Laser technicians are desperately needed now on both a national and a regional scale. A great potential need exists in both north central Wisconsin and throughout the entire state.

Ad Hoc Advisory Committee Meeting
Laser/Electro Optics Technology
NCTI Board Room - 1:30 P.M. - March 22, 1977

Chairman: Dr. Russell Paulsen

Present: Douglas Radloff, Zimpro; Dr. Louis Blumen, Wausau Hospitals; Mike Allen, Connor Forest Industries; Myron Muckerheide, Mark Laser Systems

NCTI Consultants: Richard Roberts, Ronald Schubert, Ronald Beckman, Eugene Battist, James Johnson and Paul Link

Dr. Paulsen opened the meeting by introducing those in attendance. The objectives of the meeting were outlined to the group.

The program proposal is due at the State VTAE Board office by April 1, 1977, if a program is to start August, 1977.

James Johnson explained his background and experience with lasers. He has spent the 1976-77 academic year on sabbattical leave with Technical Education Research Center (TERC) in Waco, Texas. An outline of laser training centers in the United States was explained. Four geographic areas; east, west, Florida and Chicago were identified. NCTI would serve the Chicago (mid-west) area. Some attempts have been made to begin a laser program in Vincennes, Indiana.

Past laser class offerings and their content were discussed. Program rationale and the projected needs for LEOT technicians, based on TERC projections, were discussed. Because of the difficulty in obtaining accurate information, the projections are considered conservative. Area, state and local potential was identified.

The problems of establishing a program before industry demands for laser technicians are definitely known was discussed.

The proposed LEOT curriculum was identified. Suggestion was made that future consideration be given to medical applications of the laser. Federal regulatory considerations should also be taken into account when planning the program. Possibility of offering in-service type up-dating to high school science teachers was also suggested. It was a consensus of opinion of all present that an associate degree should be sought. It was also stressed that emphasis must be given to providing the highest quality possible in program graduates.

The time line of when to begin the program if it is approved followed. Hopefully August, 1977 will become a reality.

Funding of the program was discussed.

Meeting adjourned at 3:20 P.M.

LEOT ADVISORY COMMITTEE

Local

Myron Muckerheide	Mark Laser Systems	Wausau
William Mark	Mark Laser Systems	Wausau
Dr. Louis Blumen	M.D.	Wausau
Nicholas Dobeck	Wis. Equipment, Inc.	Medford
Eugene Corolewski	Connor Forest Industries	Wausau
Dave Thorn	Drott Mfg. Co.	Schofield
Douglas Radloff	Zimpro	Rothschild

Regional

John Ready	Honeywell	Bloomington, MN
Charles Brooks	Brooks Engineering	Chicago

LOUIS J. BLUMEN, M.D.
THORACIC AND CARDIOVASCULAR SURGERY
2801 N. 7TH STREET
WAUSAU, WI 54401

TELEPHONE: (715) 842-0895

March 22, 1977

Mr. Lawrence B. Hoyt, District Director
North Central Technical Institute
1000 Schofield Avenue
Wausau WI 54401

Dear Mr. Hoyt:

I am a cardiovascular surgeon interested in the development of lasers in medicine. The last 15 years have witnessed the many biomedical applications of lasers. The field is new and I would say limited only by the expertise of the people who are in the field. As is true for many areas, the ones who are not up on the subject are apt to be down on it.

My particular area of interest has been the potential application of lasers to lung cancer. At present with all our knowledge and expertise in 1977, we are a long way from treating cancer of the lung successfully. The laser looms on the horizon as possibly another promising means of accomplishing successful cancer surgery.

I personally consider the laser problem important enough to have registered for instructional classes in the elementary and advanced classes in lasers under Mr. James Johnson. I consider our community very lucky to have an individual with Mr. Johnson's capabilities who can teach this rather new science.

With regard to the industrial outlook for laser applications, I think that the same thing will happen as in medicine. The more we use and familiarize ourselves with the laser, the greater the applications. We have come a long way from the original formulas of Einstein's and the next 25-50 years should see greater advances. On the national level there exists a mad race between Russia and the United States as to who can make a bigger laser weapon to destroy more people and land. However, if people can look beyond the destructive nature of the laser, a great deal of good can come from it.

I think that a laser program at NCTI would be most timely. We have a most able instructor in Mr. Johnson and I am sure that he will be able to attract other instructors for a comprehensive laser technology course. Certainly, the need for laser technicians is there. Wausau, for a community its size is highly industrialized and forward looking. There is no question in my mind that the individuals trained under the NCTI program in laserology will have no problem fitting into positions yet to arise here in

Wausau and elsewhere in the state. I envision many of these individuals going into biomedical positions as well. NCTI should not allow this excellent opportunity to slip by. It is timely. It is progressive and represents a forward step in the growth of a modern technological institute.

Sincerely,

Louis J. Blumen, M.D.

LJB/mg

Mark
LASER SYSTEMS

March 29, 1977

Lawrence B. Hoyt, District Director
North Central Technical Institute
1000 Schofield Avenue
Wausau, Wisconsin 54401

Dear Mr. Hoyt:

Mark Laser Systems, Inc. is extremely interested in the Electro-Optics Technology program at North Central Technical Institute. Our interest stems from the fact that we are a consulting and manufacturing firm for industrial and military weapon systems.

The rapidly expanding laser market is expected to double by 1980. Laser technology has permeated every major industry throughout the world. Industrial welding of common and unusual metals, machining of miscellaneous parts, applications in the electronics field, computer related technology, point of sale scanners, medical applications, aerospace, tracking and sensing devices, pharmaceutical manufacturing, and applications in paper and wood processing represent a few areas of application throughout the nation.

The increasing demand for laser technicians can be met by forward looking organizations such as yours. The expansion of the market is well established in the formal literature and trade journals and represents a true indication of the massive amount of influence the technology is working upon industry.

Queries by the industry concerning availability of laser technicians have been difficult to answer since only a few places in the United States train the caliber of technicians needed by the industry.

mark
LASER SYSTEMS

Mark Laser Systems, Inc. offers their support in expediting the educational process underway at North Central Technical Institute in the field of lasers. Future requests for technicians from corporations doing business with us will be directed to your organization.

Sincerely,

MARK LASER SYSTEMS, INC.

Myron C. Muckerheide
Vice President - Research

MCM:bp

Honeywell

March 25, 1977

Mr. James R. Johnson
Instructor, Laser Technology
North Central Technical Institute
1000 Schofield Avenue
Wausau, Wisconsin 54401

Dear Jim.

Thank you for your recent letter, in which you describe the proposal that you are preparing to the Wisconsin State Board of Vocation, Technical and Adult Education.

I am delighted to hear about your excellent progress in setting up courses in the laser training curriculum at North Central Technical Institute. I feel that the establishment of your proposed Laser/Electro-Optics Technology program would be very desirable for providing trained personnel for a number of developing laser-oriented industrial applications.

Technicians who graduate from your laser program will enter a laser industry which will be expanding rapidly in the next few years. One projection (by Frost and Sullivan, Inc., quoted in Optical Spectra, September,1976) predicts a doubling of U.S. shipments of commercial lasers in the period from 1975 to 1980, and a total DoD market of $3.7 billion for laser products and services in the same period.

There is a tremendous potential for growth in a number of markets. Significant items are the development of point-of-sale scanners, based on low-power lasers, for supermarket checkout and the development of videodisks with laser playback. Both of these areas offer the possibility of mass markets for large numbers of lasers in consumer-oriented products. Many technicians would of course be needed to produce, to install and to service these lasers.

Another developing market is laser-based communications systems. Prototype fiber-optic systems are being field tested by the Bell System; if the tests are successful, the telephone industry could have a great need for technical personnel trained in optics. The telephone lineman would have to install and splice fiber-optic cables and connect them to optical sources, repeaters and detectors.

The newspaper industry is undergoing significant changes, because of the introduction of laser-based wirephoto systems, laser phototypesetters, laser page composers for small composing rooms, and, possibly, large platemakers, containing several lasers each. There would be a need for technicians trained in lasers and optics in all these areas; one can envision a situation where an optical technician would be needed in every print shop.

CORPORATE RESEARCH CENTER, HONEYWELL INC., 10701 LYNDALE AVENUE SOUTH, BLOOMINGTON, MINNESOTA 55420, TELEPHONE 612/887-4500

Close to my own personal interests is the growing acceptance of large high-power lasers for welding, machining and heat treating. These lasers will be making further inroads into many industries in the next few years. Laser based resistor-trimmers are already common in companies making any kind of electronic equipment.

I am especially excited about the potential application of lasers for energy-related programs. Specifically, laser-assisted thermonuclear fusion and laser-assisted isotope separation are the subjects of large research efforts. These areas are more speculative; the probability of success remains uncertain, but the potential payoff could be very high. For a number of years, many technicians will be needed to support the growing research programs.

A continued growth of laser technology in military areas also seems assured over the next five years, in fact, the military may be the largest single user in this time period. Use by the military influences all parts of the laser industry. To support this effort many laser technicians are needed: civilian employees who operate the lasers, maintenance personnel from outside organizations, technicians at laser companies to manufacture the lasers, and technicians in research organizations working on supporting research and development contracts.

What I have outlined above touches only very lightly on a small number of laser-based applications. I hope that these examples will convey a sense of the growing utilization of laser technology in diverse industries.

Because of the expanding use of lasers, I forsee a continuing demand for laser technicians for many years. Currently there are very few such personnel available. What we have often done is to hire a technician trained in some other area, e.g., electronics, and teach him optics and laser principles on the job. Needless to say, this is not the most desirable situation, but personnel with optical or laser backgrounds were simply not available. Laser technicians trained in a program such as you are setting up would be very desirable.

To reinforce this point, let me note that graduates from the Laser Electro-Optics Technology program at Texas State Technical Institute in Waco, Texas have been very much in demand. With a background similar to what your graduates would have, they have commanded a good choice of job opportunities.

With regard to geographical considerations, I can perhaps comment best on the situation in the Minneapolis area. I feel that there will be a growing demand for laser-trained personnel in this area. I forsee further utilization of laser technology in the large companies (e.g., 3M and Honeywell) which already have diversified efforts. Also, many smaller companies should begin to use laser material processing. Medtronic, with its laser welders, is a good example.

In conclusion, I feel that there will be excellent job opportunities available for laser-trained technicians. I strongly support the establishment of the Laser/Electro-Optics Technology program at North Central Technical Institute.

Sincerely yours,

John F. Ready

John F. Ready
Senior Principal Research Scientist

JFR/dme

BROOKS ENGINEERING CO.

Technical Sales and Application Engineering

MR JAMES JOHNSON
M. C. T. I.
1000 SCHOFIELD AVE
WAUSAU, WIS. 54401

DEAR MR JOHNSON,

THANKS FOR YOUR LETTER DESCRIBING THE MCTI PLAN FOR A LASER/E-O PROGRAM AT THE INSTITUTE.

AS A MARKETING ORGANIZATION INVOLVED IN LASER TECHNOLOGY FOR TWELVE YEARS WE HAVE BECOME ACUTELY AWARE OF A SHORTAGE OF LASER TECHNICAL HELP, PARTICULARLY IN THE MIDWEST. IT IS OUR FEELING THAT 1977 IS JUST THE RIGHT TIME TO TRAIN SUCH HELP IN THAT SUBSTANTIAL SALES IN BOTH DOLLAR AND UNIT VOLUME HAVE JUST TAKEN PLACE AND ARE PROJECTED TO GROW. INDUSTRIAL LASER SALES ACCOUNTED FOR APPROXIMATELY $2 MILLION IN SALES IN THE LAST YEAR (12 UNITS) FOR OUR ORGANIZATION ALONE, AND THAT

227 E. WALTON PLACE · CHICAGO, ILLINOIS 60611 · TELEPHONE 312/944-1227
P.O. BOX 60 · STILLWATER, MINNESOTA 55082 · TELEPHONE 612/439-7222

(2)

WAS FOR THE MIDWEST ONLY!

IF YOU CAN PROVIDE INDUSTRY WITH PEOPLE TRAINED IN LASERS, LASER APPLICATIONS, MATERIAL HANDLING AND BASIC METALURGY I THINK THEY WILL BE GRABBED UP. WE WILL BE GLAD TO TO TELL YOU WHERE WE HAVE MADE SALES WHEN YOU HAVE A PROGRAM

BEST OF LUCK,

SINCERELY,

CHARLES BROOKS,
PRESIDENT

227 E. WALTON PLACE · CHICAGO, ILLINOIS 60611 · TELEPHONE 312/944-1227
P.O. BOX 60 · STILLWATER, MINNESOTA 55082 · TELEPHONE 612/439-7222

IV. Curriculum

PROPOSED LASER TECHNOLOGY CURRICULUM

		Credits	Lecture	Lab
First Semester				
804-153	Electronics Technical Mathematics I	5	5	0
806-151	Technical Science I	3	2	3
622-103	Laser Electronics I	4	3	3
622-105	Electrical & Mechanical Fabrication	3	1	4
622-101	Introduction to Lasers	3	2	2
		18		
Second Semester				
804-154	Electronics Technical Mathematics II	4	4	0
806-152	Technical Science II	3	2	3
801-151	Communications I	3	3	0
622-107	Laser Electronics II	4	3	3
622-109	Laser Optics	3	2	2
		17		
Third Semester				
801-156	Technical Reporting	3	3	0
809-153	American Institutions	3	3	0
622-111	Lasers & Electro-Optic Equip.	4	3	3
622-113	Laser Electronics III	4	3	3
	Elective	3		
		17		
Fourth Semester				
809-110	Principles of Economics	3	3	0
809-151	Psychology of Human Relations	3	3	0
622-115	Laser Applications Projects	3	2	3
622-117	Laser Electronics IV	4	3	3
	Elective	3		
		16		

Technical Core	Credits
Laser Electronics I	4
Electrical & Mechanical Fabrication	3
Introduction to Lasers	3
Laser Electronics II	4
Laser Optics	3
Lasers & Electro-Optic Equipment	4
Laser Electronics III	4
Laser Applications Projects	3
Laser Electronics IV	4
	32

Technical Related	
Technical Math I	5
Technical Science I	3
Technical Math II	4
Technical Science II	3
	15

General Education	
Communications I	3
Technical Reporting	3
American Institutions	3
Principles of Economics	3
Psychology of Human Relations	3
	15

Technical Core	32
Technical Related	15
General Education	15
Elective	6
	68

COURSE DESCRIPTIONS

First Semester:

804-153 Electronics Technical Math I

Designed to (1) develop completely (for the students with little or no algebra background), or (2) thoroughly review (for the student with significant algebraic background) the topics generally included in algebra and advanced algebra. Emphasis placed on procedures for various operations and not on abstract proof for legality of the operation. Applications are related to electronics in both algebraic and BASIC programming units. Pre-requisite: Satisfactory math placement score and one year of high school algebra or equivalent.

806-151 Technical Science I

Theory and application of: measurement, properties of matter, including mechanics of liquids (basic principles of hydraulics), mechanics of gases (basic principles of pneumatics), properties of solids based on molecular forces, magnetism, and electricity (basic D.C. and A.C.).

622-103 Laser Electronics I

Introduces the fundamental units, symbols and quantities of electronics. Deals with the various types and mathematical analysis of D. C. circuits. The course is designed to develop the skills necessary to analyze electrical measurement.

622-105 Electrical and Mechanical Fabrication

Hands-on experience with use of hand tools, measuring instruments is stressed. Techniques of fabrication such as assembly of machined parts, soldering and de-soldering, circuit component layout, circuit board production, determination of color codes and wire sizes are developed.

622-101 Introduction to Lasers

This course is designed to introduce the new student to operating principles of a laser, its output characteristics and safe operating procedures. Low power HeNe lasers are used throughout the laboratory portion of the course but an overview of all other important lasers and their characteristics is discussed.

COURSE DESCRIPTIONS

Second Semester:

804-154 Electronics Technical Mathematics II

Designed to introduce, develop, and apply various properties of trigonometry, complex numbers, logarithms, differential and integral calculus. Applications directly related to electronics. The portion of the course devoted to the calculus is designed as an introductory overview of the concepts, formulas, and basis applications with an emphasis on correct terminology in functional notation, limits, differentiation, and integration. Pre-requisite: 804-153.

806-152 Technical Science II

Covers the theory and applications of: force, motion, work, energy and power, machines, thermal energy, heat transfer, heat engines, sound, light and color radiation. Pre-requisite: 806-151.

801-151 Communications I

Designed to improve the students' ability to use the library, take notes, follow written instructions, listen accurately and critically, speak with clarity and conciseness and with self-confidence and enthusiasm in both formal and informal situations, and to write clear, concise and cohesive paragraphs and themes.

622-107 Laser Electronics II

Provides the background necessary to analyze A.C. circuits. Specific subjects discussed include capacitive and inductive reactance vector representation of phase angle, impedance, and instantaneous voltages and currents. RLC series and parallel circuits are analyzed. Principles of single phase and three phase commercial power transmission are investigated.

622-109 Laser Optics

This course combines the principles of geometric and wave optics and relates these principles to applications within the laser industry.

COURSE DESCRIPTIONS

Third Semester:

801-156 Technical Reporting

Indepth investigation into requirements of preparing and presenting oral and written technical reports. Emphasis placed on five stages of report preparation: investigating, planning, organizing, writing, and revising. In addition, portions of the course deal with business correspondence, visual preparation, audience analysis, employment orientation, problems solving, logic and reasoning. Students engage in technical reporting activities directly related to their major course of study. Pre-requisite: 801-151 and second semester standing in major.

809-153 American Institutions

A study of American economic and political institutions and social and political problems as they affect the individual as a citizen and productive member of society. Areas covered are basic constitutional concepts, the dynamics of politics, the challenge of Communism and the nature of domestic problems.

622-111 Lasers and Electro-optic Equipment

The operating theory and procedures for the safe use of medium and high power lasers are discussed. The output characteristics of both pulsed and C.W. lasers will be thoroughly investigated. The theory and operation of electro optic devices such as photodetectors, calorimeters, power meters, Q-switches and acousto-optic modulators are discussed and practiced.

622-113 Laser Electronics III

Semi-conductor and other solid state circuits such as rectifier circuits, voltage doubler circuits, transistor amplifiers, operational amplifiers, and their characteristics are evaluated. Experience with the use of mini-computers will be provided for problem solving.

COURSE DESCRIPTIONS

Fourth Semester:

809-110 Principles of Economics

An introductory inquiry into the theories, principles and policies of economics. Topics studied are related to current problems and events. Various aspects of several economies are examined in relation to specific economic goals. Selected topics include: economic structure and operation, income distribution, money and banking, price analysis, national income accounting, economic development and growth, and international economics.

809-151 Psychology of Human Relations

Introduction to the major viewpoints in psychology and their relation and influence on human behavior, to encompass physiology, motivation, emotion, perception, learning, personality, and mental health. The above topics covered in a style to allow each student to know what is pertinent to his or her particular life, keeping the problems of society in close awareness.

622-115 Laser Application Projects

Students will organize and operate projects in which lasers and other electro-optic devices are used in various applications such as cutting, drilling and welding, holographic non-destructive testing, optical communications and bio-medicine.

622-117 Laser Electronics IV

A continuation of Laser Electronics III with further emphasis on pulse forming and switching networks. Emphasis is again placed on the continued use of mini-computers.

V. Admission and Advanced Status

Students registering for this program will follow the admission procedures in the Student Handbook. (See Handbook in Appendix and Admission Application.)

VI. Student Services

For complete description of Student Services activities, please refer to the Student Handbook.

VII. Instructional Personnel

A. Projected Staff Needs

NCTI presently has an expert in laser technology on the faculty. This expertise was obtained on a sabbatical leave during the 1975-76 school year. He has also worked with other states on the east coast in developing laser curriculums. During the second year, an additional faculty member will be needed to teach part-time in lasers and part-time in laser electronics.

B. Qualifications

Instructional staff employed to teach in this program will meet certification requirements developed by the WBVTAE.

VIII. Facilities

Temporary lab facilities are available during the 1977-78 school year.

A new welding shop is being constructed on the Wausau Campus - to be completed by January 1978. Upon the move into the new welding shop, adequate lab space will be available for remodeling to provide permanent facilities for the laser technology program.

IX. Equipment

A. Equipment on hand.

NCTI presently has the following laser equipment available:

5 Low Power HeNe lasers, 2 Optical Power Meters, other supportive equipment such as optical benches, lenses, mirrors, and spectroscopes, 1 High Power Ruby Laser System, 1 Laser Energy Monitor, components from several other lasers obtained through excess property.

In addition, Mark Laser Systems of Wausau has indicated they will help design and construct the following equipment:

1 High Power CO_2 laser system capable of performing metal processing

B. Equipment to be purchased.

Approximately $15,000 to $20,000 worth of lab equipment will need to be purchased each of the first 2-3 years. If possible, some of this equipment will be obtained through the Excess Property Program. NCTI has submitted a request to the National Science Foundation for funds for equipment purchases in this area.

X. Finance

Prepare a proposed budget for the program, using the following format:

PROGRAM Laser Technician

	1st fiscal Year	2nd fiscal Year	3rd fiscal Year	4th fiscal Year
Revenue				
Local funds	3,000	5,000	7,500	10,000
State Aids	7,200	14,400	16,200	17,400
Federal Funds Source				
U.G.L.R.C.	5,000	4,000	?	?
N.S.F.	5,000	?	?	?
Voc. Ed.	10,000	5,000	5,000	3,000
Institutional	30,800	24,850	26,800	22,600
Total Revenue	61,000	53,250	55,500	53,000
Expenditures				
Instructional salaries	30,000	37,500	40,000	42,500
Instructional supplies	1,000	750	500	500
Instructional equipment	20,000	15,000	15,000	10,000
Facilities				
Remodeling	10,000			
Rental				
New Construction				
Total Expenditures	61,000	53,250	55,500	53,000
Instructional personnel	FT 1½	FT 2	FT 2	FT 2
	PT	PT	PT	PT

XI. District's Public Information Plan for Program Development

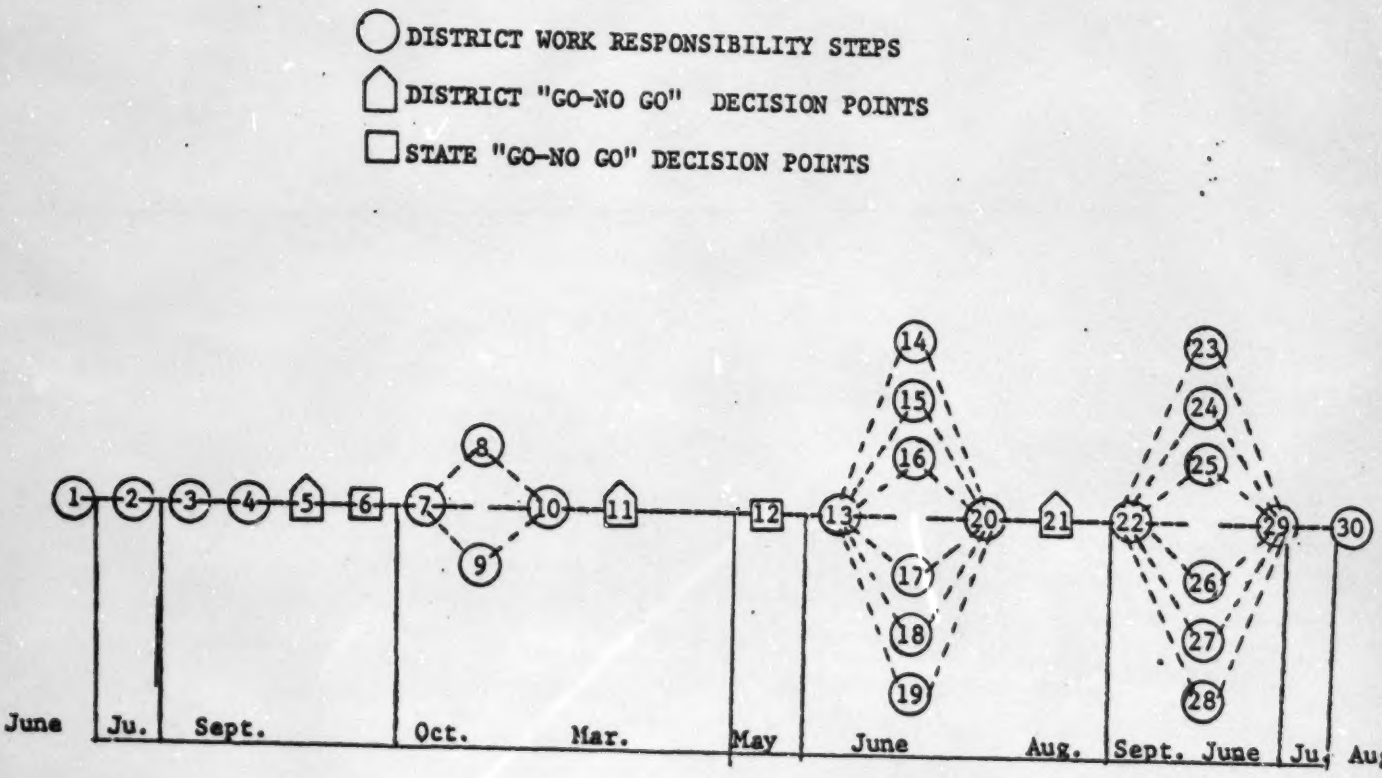
The district's communication specialist is informed at each step in the procedures for program development. New programs will be publicized only after final approval of program implementation by both the state and district boards. All public media will be utilized in all practical ways to inform potential students and the general public of new programs.

XII. Program Implementation

5. New Program Development

To tie in with the new state guidelines for program evaluation and development, the North Central Technical Institute has recently developed the following flow chart which specifies responsibility and defines the process for new program development.

NEW PROGRAM DEVELOPMENT FLOW CHART



New Program Development (Keyed to Flow Chart)

1. Annually review and evaluate all programs with recommendations for change or discontinuance. (Administrator, Instructional Services-Curriculum Evaluation Study Committee)

2. Review and update the five year plan for new curriculum development with recommendations for those to start the following fall and the year from the following fall and two years from the following fall. Give careful review to those programs designed to start the following fall and a year from the following fall and make a recommendation on which program should begin two years from the following fall, to the District Director. (Administrator, Research and Development-Curriculum Evaluation Study Committee)

3. Review recommendations for discontinuance or change of existing programs as well as those recommendations for approval of the initiation for new programs. Approve or disapprove the status of programs to start the following fall, a year from the following fall and two years from the following fall. (Director)

4. Develop an "indication of interest" statement for all new programs approved to start two years from the following fall and identify the principle investigator for each new program. (Administrator, Research & Development) After consultation (Administrator, Instructional Services, and Administrator of Community Services, department chairmen and a representative from the state staff)

5. Approval of the indication of interest statement and submission of indication of interest statement to the state board. (Director, District Board)

6. Approval of indication of interest statement thereby authorizing preparation of the new program proposal. (State Director, State VTAE Board)

7. Development of a proposal for a new program. (Administrator, Research and Development)

8. Consult with all members of the Curriculum Evaluation and Study Committee, communications specialist, the department chairman, the coordinator, the general education department chairman, instructional media specialist, the librarian, and a state VTAE Board consultant. (Administrator, Research and Development)

9. Establish and meet with potential program AD HOC advisory committee. (Administrator, Research and Development, Department Chairman and Principle Investigator)

10. Finalize proposal with Curriculum Evaluation and Study Committee and Ad Hoc advisory committee. (Administrator, Research and Development-Department Chairman, Principle Investigator)

11. Approve the proposal and submit the proposal to state VTAE Board. (Director, VTAE Board)

12. Approval of proposal authorizing the start of the program. (State Director, State VTAE Board)

13. Review a proposal as approved by the State VTAE Board by the Curriculum Evaluation and Study Committee and an appropriate state VTAE Board consultant. (Administrator, Instructional Services-Department Chairman)

14. Establish a continuing advisory committee.

a. recommend possible members to the District Director (Administrator, Research & Development-Department Chairman)
b. refine the list of possible members and approve that list (Director)
c. select and approve members of the continuing advisory committee (District Board)
d. conduct first meeting of continuing advisory committee followed by others as needed (Administrator of Research and Development-Department Chairman)

The committee should contain a minimum of six members. The following areas may be represented:

Employer, employee, recent graduate, appropriate professional practitioner, official agency and organizational representatives, university representatives and department chairman. Ex-officio membership from other sources would be appropriate such as: student services, general education, community services, research, instructional services, and state staff. The primary function of this advisory committee would be to advise the district concerning such areas as staff qualifications, facilities, instructional equipment, curriculum, student recruitment, and student job placement.

15. Study physical facility needs:

a. determine the physical facility needs for the new program. (Administrator, Instructional Services-Department chairman)
b. analyze the use of the existing physical facilities (Administrator, Instructional Services-Department Chairman)
c. recommend use of existing facilities or development of new facilities (Administrator, Instructional Services-Department Chairman)
d. approve or disapprove the facility usage recommendation (Director)
e. make plans to provide facilities (Director-Administrator, Administrative Services)

16. Complete curriculum development plan

a. determine course content unique to the new program (Principle investigator, Department Chairman, Administrator-Instructional Services)
b. analyze course content of existing courses to be included in the curriculum (Principle investigator, Department Chairman supervisor, Administrator, Instructional Services)

c. establish course titles and numbers (Department Chairman-Administrator, Instructional Services)

d. determine the instructional methodology (Principle investigator, Department Chairman, and Administrator, Instructional Services)

This will include a tentative breakdown of the time spent in the class in lecture, laboratory or planned learning activity, shop, or individualized instructional lab. The activities conducted within the laboratory settings will be tentatively identified. The locations for any extended laboratory experience will be identified early so that the necessary liaison may be established with the outside agency.

e. determine the method of course evaluation (Principle investigator, Department Chairman, and Administrator, Instructional Services)

The procedure and instruments for evaluating student progress toward the specific course objectives will be tentatively established at this point.

17. Establish the instructional staffing plan (Department Chairman-Administrator, Instructional Services)

18. Make plans for student recruitment:

a. plan published materials (Communications Specialist)

b. make plans for informing the news media (Communications Specialist)

c. make plans for high school visitations (Administrator, Student Services and staff)

19. Review the proposed budget for the program as submitted in the proposal to update the cost figures (Department Chairman, principle investigator, librarian, media specialist)

20. Review the status of the program (Curriculum Evaluation and Study Committee-Administrator-Instructional Services) Make a recommendation to the district director regarding the status of the program development.

21. Approve the continuance of the program in its developmental process (Director) and authorize public information dissemination on the program.

22. Release news to the news media and send materials to the printers for all published materials such as brochures which will be used for student recruitment. (Communications Specialist)

23. Make high school career days visitations and inform high school counselors about the start of a new program through the news letter. (Administrator, Student Services and staff)

24. Initiate staff recruitment

    a. recommend faculty and other instructional positions to the District Director (Administrator, Instructional Services-Department Chairman)
    b. approve or disapprove the recommendations (Director)
    c. announce positions with local faculty and through placement agencies (Administrator, Instructional Services)
    d. obtain credentials on perspective candidates (Administrator, Instructional Services)
    e. interview perspective candidates (Department chairman, Administrator, Instructional Services, and Director)
    f. Recommend employment (Director, District Board)
    g. orient new staff (Department Chairman-Administrator, Instructional Services-Director)
    h. request certification (Administrator, Instructional Services)

It is desired that the new instructional staff be identified and working prior to the start of the program inasmuch as this staff needs to be responsible for such activities as finalizing course content, purchasing of instructional equipment, supplies and an orientation program for the new instructional staff is also essential.

25. Order instructional equipment and instructional materials (Department Chairman, Instructional Media Specialist, Administrator-Instructional Services, Administrator-Administrative Services, principle investigator, and/or new instructional staff)

26. Refine the curriculum in each new course (Principle investigator, and/or new instructional staff, Immediate Department Chairman, Administrator-Instructional Services)

    a. Course objectives
    b. Course outlines
    c. Courses of study
    d. Learning activities
    e. Evaluation instruments
    f. Bibliography listing of readings

27. Order textbooks and supplies (District Course Scheduler, Department Chairman)

28. Schedule courses, instructors, and rooms (District Course Scheduler, Administrator-Student Services and staff, Department Chairman)

29. Freshman orientation and pre-registration (Administrator-Student Services and staff, Department Chairman and Faculty)

30. Instructional program commences (new instructional staff)

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